



Early Journal Content on JSTOR, Free to Anyone in the World

This article is one of nearly 500,000 scholarly works digitized and made freely available to everyone in the world by JSTOR.

Known as the Early Journal Content, this set of works include research articles, news, letters, and other writings published in more than 200 of the oldest leading academic journals. The works date from the mid-seventeenth to the early twentieth centuries.

We encourage people to read and share the Early Journal Content openly and to tell others that this resource exists. People may post this content online or redistribute in any way for non-commercial purposes.

Read more about Early Journal Content at <http://about.jstor.org/participate-jstor/individuals/early-journal-content>.

JSTOR is a digital library of academic journals, books, and primary source objects. JSTOR helps people discover, use, and build upon a wide range of content through a powerful research and teaching platform, and preserves this content for future generations. JSTOR is part of ITHAKA, a not-for-profit organization that also includes Ithaka S+R and Portico. For more information about JSTOR, please contact support@jstor.org.

THE WESTERN INTERIOR GEOSYNCLINE AND ITS BEARING ON THE ORIGIN AND DISTRIBUTION OF THE COAL MEASURES¹

FRANCIS M. VAN TUYL
University of Illinois

While occupied with a study of the stratigraphy of the Mississippian formations of Iowa for the Iowa Geological Survey the writer has been attracted by the regular and nearly uniform gentle dip of these formations to the southwestward, and he has recently attempted to ascertain the age and significance of the deformation which gave rise to this. Investigation soon showed that the tilting was related to deformation over a wide area in southern Iowa, southeastern Nebraska, eastern Kansas, and northwestern Missouri which outlined a great southwestwardly pitching geosyncline in which the Coal Measures of the western interior coal field were deposited. The evidence is clearly in favor of the view that the movement took place, in part at least, during pre-Pennsylvanian time, as shown by the fact that the Coal Measures now rest upon truncated Mississippian formations successively younger in age toward the southwest. This belted arrangement of the Mississippian deposits beneath the Coal Measures cannot be accounted for on the assumption that the distribution of the former is original, since the beds often consist entirely of nearly pure limestone up to their very boundaries and show no indications of shore facies.

That the geosyncline was shallow in early Pennsylvanian time is indicated by the fact that the maximum known thickness of the deposits of the Cherokee stage, which probably represents the time of greatest sea extension in this basin during the Pennsylvanian, is only 712 feet. At the present time, however, it attains a known depth of approximately 2,400 feet at McFarland, Kansas, and future drill records will probably show it to be considerably deeper than this to the southwest. The deepening is believed to have

¹ Published with the permission of the Director of the Iowa Geological Survey.

been brought about in part by subsidence during the post-Cherokee stages of the Pennsylvanian and in part by post-Pennsylvanian deformation. The data are not sufficient at present to warrant an estimate of the relative importance of each of the two. There is evidence that the original outlines and relations of the basin have been considerably modified by these later readjustments.

The magnitude and significance of the basin have been demonstrated by the construction of 100-foot contours on the base of the Coal Measures, from data furnished by the reports of the state geological surveys of Iowa, Missouri, and Kansas (Fig. 1). Contours showing the altitude of the base of the Coal Measures in Missouri have already been drawn by Hinds and Greene,¹ and these have been copied directly. Norton has also drawn a similar contour map for the southwestern and south-central portions of Iowa,² and this has been adopted with little modification.

The presence of this basin not only explains the great dissimilarity between the Coal Measures of this field and those of the eastern interior field, which were undoubtedly deposited in a distinct basin, but also explains the belted arrangement of the outcrops of the Pennsylvanian formations in Iowa, Missouri, and Kansas, where the younger members are approximately confined to the center of the basin, progressively older ones being exposed toward its margins.

There can be no doubt that this geosyncline exerted an important influence on sedimentation in this region during the Pennsylvanian. The work of Hinds and Greene in Missouri has furnished valuable data bearing on this point. Referring to the Cherokee deposits of that state they say:

The Cherokee sea, advancing from the west or southwest, first invaded Missouri in the vicinity of Forest City, Holt County, and soon extended northeast as a long shallow arm through Worth, Harrison, and Mercer counties into Iowa. When about 150 feet of Cherokee sediments had been laid down the arm had broadened out to the southeast so as to embrace Buchanan and Platte counties, and a short time later Clay, Jackson, and Livingston counties. After the deposition of nearly 400 feet of material in the Forest City area the sea covered practically all of the western tier of counties, except Atchison, and

¹ *Mo. Bur. Geol. and Mines*, Vol. XIII, 2d Ser. (1915), Pl. 25.

² *Iowa Geol. Survey*, XXI (1912), 1101.

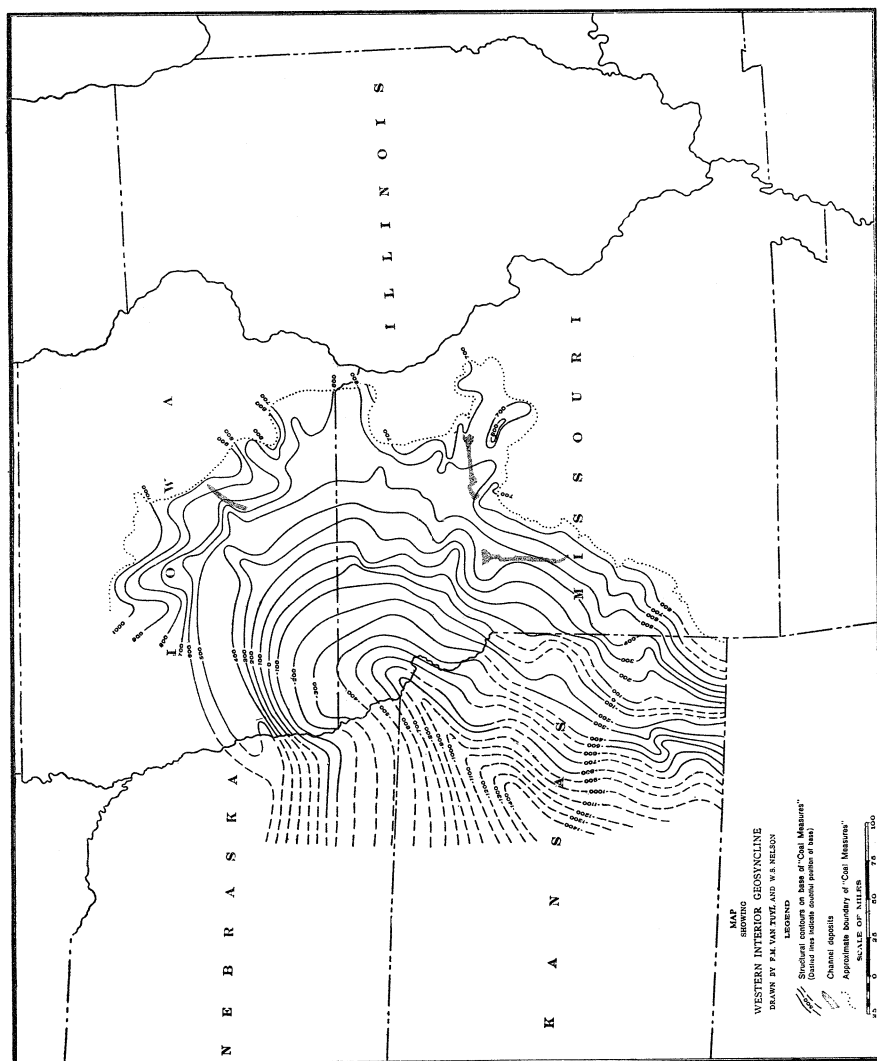


FIG. 1.

soon extended eastward into Henry, Johnson, Lafayette, Roy, Carroll, Linn, Putnam, and Adair. When the Bevier coal bed was formed, near the beginning of Allegheny time and after the deposition of 580 feet of material at Forest City, some sedimentation had already taken place in all the region now occupied by the main body of the Pennsylvanian and a fairly large area in which there are now only small patches remaining. The land area had been reduced to an island in southeastern Missouri, with a peninsula projecting into Pike and neighboring counties and a small part of a northern land mass in the extreme northwestern corner of the state. The western sea continued to advance eastward while an eastern sea occupying most of Illinois advanced westward. Probably by the end of Cherokee time the two seas had joined, submerging practically all of northern Missouri and possibly nearly all of southern Missouri also. No deposition appears to have taken place at this time in the extreme northwestern corner of the state, for the Nebraska City drilling shows less than 100 feet of Des Moines strata, probably of Pleasanton age.¹

That these authors are justified in this conclusion is shown by a study of the thicknesses of the Cherokee in Missouri as listed by them.² Thus at Forest City in Holt County the thickness is 712 feet, while its average thickness in the counties to the eastward becomes successively less and less, viz., Livingston 450, Linn 260-310, Macon 175, Audrain 75. To the southeastward a similar relationship is shown, thus: Buchanan 530, Platte 555, Clay 460, Jackson 430, and Johnson 220-350 (see Fig. 2).

The influence of the basin upon the thickness and character of the post-Cherokee stages of the Pennsylvanian is not so obvious. The writer, after a careful study of all the available data, including deep-well and drill records from various parts of the area, has not been able to find any consistent variation in the thickness and lithologic character of the formations in tracing them from the center of the basin toward its margins. Nevertheless, the lack of relation between these deposits and those of the Illinois field suggests that the basin persisted and that its gradual though interrupted subsidence made possible the deposition of the Pennsylvanian formations of this province. It is believed that the original relations have been masked in large part by disconformities within the Coal Measures, several of which have been recognized, and by post-Pennsylvanian erosion, which has almost entirely removed the marginal facies of all the formations younger than the Cherokee.

¹ *Op. cit.*, p. 209.

² *Op. cit.*, pp. 39-40.

Pennsylvanian time. If, as suspected, the channel deposits are contemporaneous with certain sandstones and conglomerates of late Pleasanton age in north-central Missouri, this erosion interval occurred before the beginning of the Missouri epoch.¹

The location and trend of the channels are shown on the accompanying map (see Fig. 1). The east-west channel has been designated the "Warrensburg" and the north-south one the "Moberly."

In describing these deposits Hinds and Greene state that—

the Warrensburg sandstone fills a channel about 50 miles long, extending from north of Lewis Station, Henry County, northward to the north bluffs of Missouri River. The sandstone belt, as at present exposed, has an average width of two miles, but just south of the Missouri widens to six miles. . . .

The Moberly channel extends from South of Madison, in Monroe County, west to Chariton River south of Salisbury. Its length is nearly 40 miles and its average width less than 3 miles. The maximum depth shown in drill records is about 200 feet.²

With regard to the nature of the streams which gave rise to the channels the same authors express themselves as follows:

It is believed that the Warrensburg channel was made by water flowing from higher country on the Ozark dome, bringing with it sands and muds derived largely from early Pennsylvanian sediments. The Warrensburg stream was joined when it reached the present site of Missouri by the Moberly River descending westward from an Ozark peninsula in northeastern Missouri, and the united streams continued northward or northwestward to the open sea.³

Referring to the channel deposits presumably of a similar age in Iowa, Hinds and Greene say:

The Red Rock sandstone of Marion and Jasper counties, Iowa, lies in a channel $2\frac{1}{2}$ to 3 miles wide that has been traced for 27 miles from Eagle Rock northeastward. This sandstone has a maximum thickness of 100 feet and has all the characteristics of the Warrensburg and Moberly sandstones.⁴

It will be noted that the trend of these old channels, both in Missouri and in Iowa, indicates that the drainage development during the temporary uplift in late Des Moines time was influenced by the geosyncline.

¹ *Op. cit.*, p. 91.

³ *Ibid.*, p. 93.

² *Ibid.*, pp. 95 and 97.

⁴ *Ibid.*, p. 94.

POST-PENNSYLVANIAN HISTORY OF THE BASIN

Subsequent to the deposition of the Paleozoic the Mississippi Valley region was uplifted. It seems probable that the geosyncline was deepened somewhat at this time and that secondary folds were developed. But the fact that the regularity of the basin has not been appreciably interfered with indicates that this secondary folding was not of great importance. Following this uplift the region underwent peneplanation. That the deposits occupying the geosyncline were peneplained by the beginning of the Upper Cretaceous is shown by the fact that the basal deposits of this age rest upon the beveled edges of the dipping formations, ranging in age from the Lower Mississippian on the margin of the basin in Iowa to the Permian in Kansas, at approximately the same elevation everywhere.

There is no evidence of further movement of the geosyncline during or since the Cretaceous apart from the regional uplift which brought the area to its present level. The present course of the Missouri River across the basin was obviously taken some time after the development of the peneplain.